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Stream channel characteristics and discharge mutually affect metabolic activity in a first-order boreal stream

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Stream water quality and greenhouse gas production are both influenced by the metabolic activity of stream ecosystems. Understanding the temporal and spatial variability of metabolism is paramount for the implementation of effective mitigation measures aimed to improve stream water quality. We analysed the influence of various stream segments on the metabolic activity of a first-order boreal stream under contrasting discharges. The stream segments differed mainly in their slope and corresponding stream bed characteristics (step-pool sequences vs pool-riffle). Constant-rate tracer injections of the reactive tracer Resazurin under different discharge conditions (drought, flood, natural) were conducted and the tracer's reduction due to aerobic metabolic activity was measured within the stream segments. We observed that steep stream segments, with a high number of plunge pools and transient storage zones, exhibited increased metabolic activity compared to low gradient segments. This contrast appeared more pronounced during low discharges with high water residence times. Localised groundwater inputs, which locally coincide with the steep segments, might additionally have contributed to increasing metabolic activity. We conclude that the impact of specific stream bed characteristics changes under varying discharge conditions. Additional, local factors might have a significant impact on the metabolic activity of stream ecosystems and need to be considered carefully, when conclusions are drawn about the factors controlling stream metabolism.